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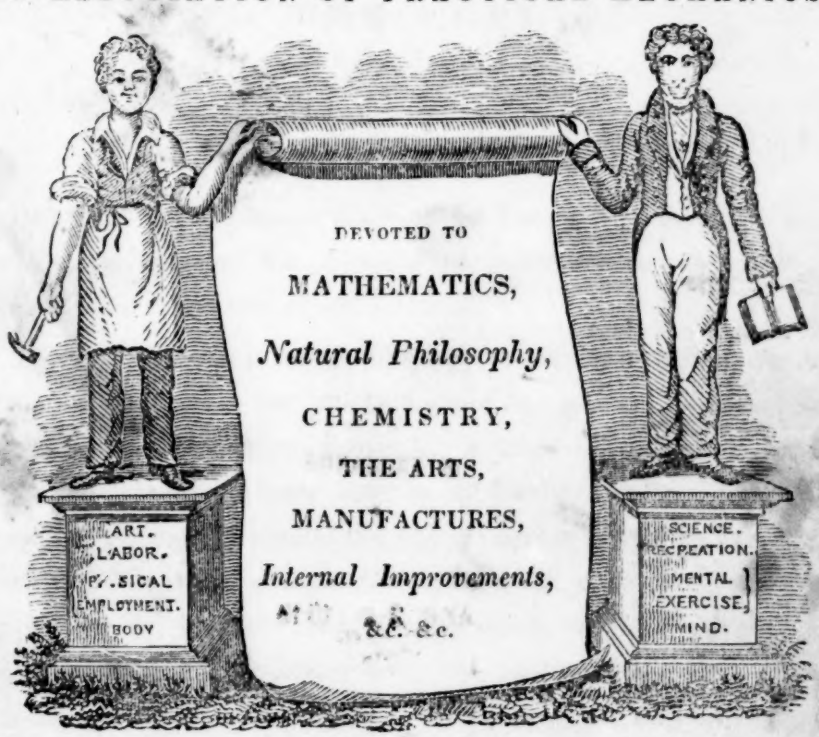
Boston mechanic

THE YOUNG MECHANIC.

CONDUCTED BY

AN ASSOCIATION OF PRACTICAL MECHANICS.



To promote one's own pecuniary interest is well—to promote that of one's neighbor at the same time is better—but to enlarge the powers, increase the energies, and improve the condition of a very extensive population, in conjunction with the two preceding objects, is best of all.—TENNANT.

VOLUME II.

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TO THE PUBLIC.

In presenting the last number of the Young Mechanic for this year to its patrons, the Association under whose control it is issued, have a few statements to make.

The delay of this number, has been occasioned by an uncertainty with regard to the continuance of the work. The association, having labored gratuitously for it since its commencement, and besides incurred some loss in its publication, considered it against their duty to pursue the object farther unless an arrangement could be made to place the work upon a more firm basis. This they had learned could not be done without enlarging it, making a variety of improvements, and raising the price. They stated the case to several spirited individuals, and they are happy to say that a number of responsible persons have declared, not only by words but by actions, that there *shall* be a Mechanics' Magazine published in the metropolis of New England. A proposition has been made to procure a *fund*, by donations and shares in the proprietorship—as there must be capital in order to make the work what it ought to be—to be called the Mechanic Fund, the surplus of which, if there shall be any over and above what is wanted to insure the success of this work, to be devoted to the encouragement of mechanical genius, or to the improvement of mechanics in some other way. This proposition has been met *promptly and liberally by a number of individuals*, and there is a fair prospect that a work containing at least double the present

quantity of matter, and well conducted in all its departments, will be placed upon a permanent foundation. The first number will probably appear in January. In the mean time, we would request all who are friendly to the improvement of the operative classes, and especially to the present object of the Association, to aid the forthcoming work, by donations to the fund, by inducing others to subscribe for it, or at least by their own subscriptions. We trust that all our present subscribers will not only continue their patronage, but render us some assistance in circulating the work as widely as possible.

Donations or subscriptions may be directed to T. Claxton, 23 Water Street, or to Geo. W. Light, Publisher, 3 Cornhill, Boston.

Boston, December, 1833.

THE

YOUNG MECHANIC.

JANUARY, 1833.

For the Young Mechanic.

SCIENCE AND ART.

We are indebted to what has been emphatically styled the *reformation*, for the light of truth in the natural and intellectual world. Previous to that eventful period, the dogmas of the church held in fearful control men's minds and consciences, and none were allowed to think or act but in subserviency to papal dominion, and monkish superstition. Had not some bold and enterprising geniuses arose, regardless of every authority but reason and common sense, the world would, at this very day, have been enveloped in a darkness worse than that of Egyptian—a darkness that would have obscured every ray of light in the human mind. Independence guided the course of those bright luminaries in science, that dispelled the clouds of superstition and bigotry in the moral and scientific world: such as Kepler, Gallileo, Copernicus, Bacon, Newton, Locke, and a hundred others, distinguished for depth of reasoning and profound research. Bacon took the lead, and in his *Novum Organum* [New Organ] he delineated a new path for the human mind to travel, which would infallibly lead to accurate and definite results. This admirable production gave an impetus to mind, which placed it beyond the tramels of sophistry and syllogism, and established it on the permanent basis of induction. This puts nature to the test, by a thousand trials—incorporates into one vast intellectual machinery the whole visible creation—gives a revelation to those secrets, which, in spite of syllogism, had lain dormant for ages—and, by this discovery, arts and sciences have

been originated, improved, and perfected, to the infinite advantage of mankind.

It is worthy of remark, that, at the time the *Novum Organum* was ushered into existence, the world had seen no model of inductive reasoning, whence its rules might be drawn with amplitude and precision. Poets had sung, and orators declaimed: their arts were perfected before Aristotle had described them. His rules were inferred from the most perfect models of those arts. But the art of interpreting nature in all its windings and sinuosities, was but imperfectly understood, when Bacon, with an uncommon energy of intellect, delineated its features, and described its proportions. His modesty was commensurate with his wisdom and talents. It was not his aim, as it was that of his predecessors, to establish a new sect, and thus immortalize his fame in the annals of a party. He was influenced by more exalted motives, and more animated views. His design was of a more laudable and glorious nature; no less than to instruct the world, to unrivet the shackles of mind, to follow nature in her simple attire, and to point out the true method of philosophizing. With a boldness characteristic of a genius of the first order, he delineated a new chart of knowledge. Unawed by imprisonments, and the anathemas of the church, he undauntedly stood forth in opposition to a world of religious bigotry, and laid the foundation of the true philosophy. This has received the adjusting hand of the immortal Newton, who has examined it with the scrutiny of mathematical research. Since Newton's time, the arts connected with natural philosophy, have rapidly progressed. The last and the present century have been eminently distinguished for important inventions and discoveries. We live, physically speaking, in an age of wonders. Humanity has its friends; choice spirits of genius have exerted themselves, and are still active in the diffusion of knowledge, and at no time has their influence been so extensive as at present. At a time when the voice of the warrior is silenced by the bland and gentle sounds of the arts of peace, in Europe and America, the whole civilized world is turning her attention to the cultivation of literature, science and art. England, with her immense resources, is annually exhibiting new constellations, whose rays are diffused through the intellectual and moral world. The republic of letters is enlarging its boundaries—genius, in whatever clime reared, or to whatever creed belonging, is courted, patronized, and encouraged.

Canal and steam navigation have opened a new source for philosophical investigation, and the railway system, with locomotive engines, is attracting attention in every part of our country. For the successful prosecution of these varied objects, extensive mathematical and physical knowledge is required. The period will soon arrive when the whole fund of American genius will be put in requisition to keep pace with the enterprise and demand of our citizens. The extensive territory which we inhabit, the innumera-

ble resources with which Providence has blessed us, and our fathers purchased and bequeathed to us, are a sufficient guarantee for a remuneration of our labors in the acquisition of science, and for the time spent to compete with the rapid march of improvement.

No nation ever enjoyed such extensive physical advantages as America. The God of nature has been exceedingly bountiful, and, as faithful stewards, we have improved our talents. We have not only had our full share of inventions, but we have readily adopted and improved those of other nations. No new machine is constructed, no new application of principle is made in England, but almost simultaneously it is adopted in America. Every improvement in the arts in England, is, as by magic, transferred across the Atlantic, and extensive and profitable establishments made in America, long before the principles are scientifically understood by nations within a few leagues of the English coast.

The following statement redounds much to the honor of American genius and enterprise.

Sixty years ago, the genius of Mr. Watt constructed the steam engine, the most wonderful of those auxiliaries which science has furnished to aid the powers of man. The distance from England to France is only twenty-one miles. Such an important improvement might have travelled to the latter country in a very short time, and, one would have supposed, before it had measured half the distance of the Atlantic. But it so happened, that while her men of science have explained its theory and eulogised its nsefulness, her manufacturers have been in no haste to avail themselves of its power. Her artizans in general have remained ignorant of its construction. America has produced only two or three treatises on the theory of the steam engine, and not *one* before she had applied the theory in all its bearings ; but she has done better. The art was not long practiced in England, before it was transported across the Atlantic to Philadelphia, there much improved, and many years before the steam engine was known in Paris, it was made in the highest perfection on the west side of the Allegany mountains, at Pittsburgh, a town which scarcely existed when Mr. Watt made his discoveries.

Nearly the same remarks will apply to steam navigation. America caught it, improved it, sent it to England, a new and perfect art of boundless utility and power. What had France been doing, while England and America had been reciprocating improvements? The men of science, who surrounded the French government, had made steam navigation the subject of prize essays, and ingenius speculations. Much had been written, and the powers of the *integral calculus* exhausted in illustrating high and low pressure, centres of percussion, and planes of resistance. In the mean time the rivers and coasts of France were navigated by vessels built after the model of the fifteenth century ; and were without a single steam boat, when nearly three hundred were plying on the rivers and coasts of America. J. R. C.

CHEMISTRY.

THE following communication is from a practical chemist. Arrangements are made to publish his manuscripts, with such elementary principles as he may deem necessary. We have commenced with an article on Light.—EDS.

For the Young Mechanic.

MESSRS. EDITORS—In some early numbers of the Young Mechanic, I noticed a few pages devoted to exemplifying some of the first principles of chemical science; in which its object, the laws of attraction, and the phenomena of heat, were treated. The numerous and various advantages to be derived by all classes of society, in every profession, from a knowledge of chemistry—the wide field it offers for agreeable amusement—the knowledge it affords respecting the natural laws—and its power of disciplining many powers of the mind—induced me to hope that the subject might be continued, and in such manner that all these purposes might be effected, while its main object, that of rendering it practically useful to those for whom the pages of the magazine is intended, should be constantly kept in view.

Notwithstanding the many valuable works on chemistry, great difficulty is found by those engaged in chemical experiments, and more particularly by those unacquainted with the science, or such as cannot command an extensive library, in obtaining, at all times, the particular knowledge of which they are in pursuit; thus in obtaining some one or more of the properties of a body, many volumes may be looked over before the knowledge is obtained, and with those who have frequent occasion to make such references, their search will frequently be unavailing. In addition to this, there are few works on chemistry which have not some statements calculated to lead those unacquainted with the subject widely from the truth. I allude principally to those statements to which the mechanic and manufacturer have most occasion to refer; nor is it to be expected that the theoretical chemist merely, should be acquainted with the difficulties, comparative expenses, &c. of the application of the processes he describes, on an extensive scale; yet much might be done, and much would be undone, were our works on the subject to proceed more from the laboratory, and less from the closet.

Having myself experienced much difficulty and frequent loss of time, for want of a systematic and complete work to refer to, I, a year or two since, commenced one, with the hope that it might, in some degree, obviate the difficulties before mentioned. The method pursued was to give, first, the most important information to the student and experimenter, and afterwards those of less importance; thus facilitating the progress of the student by enabling him to take at pleasure a detailed or more general view, but

more particularly to render it of easy reference to the experimentist and the artizan. Thus far the principal portion of experiments mentioned, have been repeated, and when any thing new in itself, or differing from former statements, has been advanced, it has been confirmed by repeated experiment and severe scrutiny.

I have been thus particular in stating the object for which the manuscripts I possess, and am now engaged with, are intended, in order that you may judge of their fitness for insertion, in monthly numbers, in the magazine. Should you deem them so, I shall, after treating briefly on the elements of this science, which are most important, proceed with my manuscript before mentioned, and shall be fully compensated, if I am able to do any thing towards assisting the artizan in his profession, or diffusing more widely a knowledge of the natural laws.

J. H. B.

LIGHT.

This is one of the great powers which produce and influence chemical phenomena. A general history of the effects produced by light, belongs to the science of optics. Some of its properties, however, it is necessary should be understood, in order to acquire a correct knowledge of chemistry.

Light is generally spoken of as matter. The question of its materiality is by no means settled.

The hypothesises invented to account for the operation of light and caloric, are two: one, that the universe contains a subtle elastic media, the vibration of which produces the effects of light; the other, that particles are sent off from luminous bodies, which enter into and change the composition, or communicate their motion to bodies. The latter was the opinion of Sir Isaac Newton, and he has put the query, whether light and common matter are not convertible into each other.

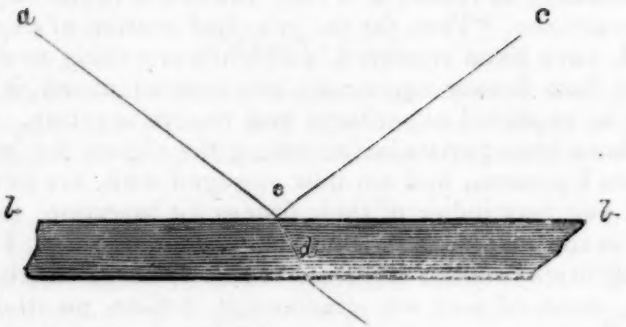
The principal source from which our globe receives light, is the sun. It is also the result of combustion, chemical action without combustion, electric and voltaic action.

The motion of light is progressive; it has been found to require about seven minutes to come from the sun to the earth—hence its velocity is about 200,000 miles in a second.

It moves in straight lines. If a ray is bent, it is always at an angle.

It passes unequally through different substances; by some it is wholly interrupted. Those through which it passes, are said to be transparent, and those which intercept it are said to be opaque.

A ray of light (*a*) suffered to fall obliquely upon a plate of glass, (*bb*) a portion (*c*) will be reflected; the remainder (*d*) which passes through the glass will be refracted towards the perpendicular.



The portion reflected may be transmitted, and the portion transmitted, reflected. This and similar phenomena are ascribed to certain poles, which the particles are supposed to possess, being differently directed at different times. Hence the term polarization of light.

The angle of incidence (*a be*) is always equal to the angle of reflection (*cbe.*) The degree of refraction is in most cases proportionate to the density. Inflamable bodies, however, possess the power to refract light in an eminent degree. A knowledge of this fact led Sir Isaac Newton to infer that the diamond contained combustible matter, an opinion which has since been confirmed.

Light is capable of division, by being passed through a triangular prism of glass, into seven colors.* The names, the proportions of the spectrum which each occupies, and the order of their refrangibility is as follows :

Red	45
Orange	27
Yellow	48
Green	50
Blue	50
Indigo	40
Violet	80

Besides the *colorific* rays (those before enumerated) there are others, which have received the name of *calorific*, or heating, and *chemical* rays. It has been found that the greatest heat is produced without the visible spectrum, beyond the red ray ; and the greatest chemical changes have been found to be produced immediately beyond the violet ray.

The rays thus separated by the prism are incapable of further division. Collected by a lens, they reproduce white light.

Diversity of color is supposed to be owing to the absorption of some rays, and the reflection of others ; thus, all the rays being absorbed by a body, but the red, that ray, being reflected by the

* The separation of the rays is occasioned by the difference of refrangibility. A very good prism for this purpose, may be made of three strips of window glass, about five inches long and 1 1-2 wide, by cementing them together at the edges, closing the ends by triangular pieces of wood, and filling with water.

body, would produce in us a sensation to which we give the name red.*

Light possesses an important chemical influence. Not only the color, but the pungent and aromatic properties of vegetables, are, in a great degree, owing to light. Advantage is taken of a knowledge of this fact by gardeners, in rearing cellery. Excluded from light, it is mild and white, but acrid and poisonous if not thus excluded. Some chemical compounds are decomposed and otherwise altered by light, as will be shown hereafter. A solution of salt, ready to chrystallize, if placed in a vessel, one side of which has been darkened, it will be found that chrystallization will commence on that side left uncovered.

The action of light upon animals, is not less important or powerful than upon vegetables, as may be shown by comparing worms, grubs, and those animals which live in the ground, with those exposed to the light. Among men, also, great difference is to be found between those who are confined within doors, and those whose occupation requires their exposure to the sun.

Beside the effects mentioned, it has been advanced that light has the power of magnetizing needles. According to Mrs. Somerville, who has made numerous experiments upon this property of light, sewing needles exposed to the violet ray for about two hours become magnetic ; exposed to the indigo, the blue, and the green, the same effect is produced, though in a less degree, while the remainder of the rays do not effect any change.

Some bodies have the property of emitting light in the dark, after having been exposed to the sun's rays. A diamond thus exposed, and covered immediately after with wax, will emit light, upon the wax being removed, in a dark room. Several artificial substances which possess this property, will be mentioned hereafter.

For the Young Mechanic.

PATENT OFFICE.

Messrs. Editors—I have never visited the patent office ; but from what I can learn of those that have, it must be a rich treat to persons of an ingenious turn of mind. Comparatively few persons however, who would be likely to profit by the examination of the

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* The ideas of color, excited in different individuals by the same object, are very different. Dr. Spurzheim mentions having known many instances in different parts of Europe ; among them a whole family who could distinguish only black and white. The color of chlorine to me appears yellow—to most persons a greenish yellow. By candle light, pink and yellow appear alike. In the Ph. Tr. 1777, mention is made of a gentleman, who bought and wore a scarlet dress, supposing it to be drab, and still was a good judge of pictures. An interesting article, by Mr. Dalton, describing his own vision, may be found in the Edinburgh Journal of Science, July, 1831.

models deposited at Washington, are able to go there for that purpose ; and, further, I understand that but a small proportion of the models are worth examining ; and among such a multitude of materials, good, bad, and indifferent, the mind gets so bewildered that unless a person can devote considerable time to the examination, he is but poorly paid for the loss of time and expense necessarily attendant on a journey of five hundred miles or more.

In conversation with a friend on this subject, some months ago, a plan was suggested which, if carried into effect, would bring the benefits of the patent office within the reach of every ingenious man. The plan is this. Let the best of the models be selected, and duplicates made from them. Say one for each State. Let these models be transmitted to the Governors of the respective States, so that in the capital of each State we may have a deposit of what is most useful in the patent office.

There is every year considerably more money received into the Treasury, on account of patents, than is expended. To what better use could this surplus money be appropriated ? Suppose ten models were selected annually, and thirty made from each, or three hundred in all. At ten dollars each, they would amount to three thousand dollars. There are about three hundred working days in a year, exclusive of holidays, so that a model would be a day's work on an average. If a foreman, at eight hundred dollars, and two other mechanics, at five hundred dollars each per annum, were employed, there would then be twelve hundred dollars left for materials, &c. It would probably cost two thousand dollars for a good set of tools, suitable for such an establishment.

Would not this be a good school were many an ingenious young man would be glad to work a year for what he could learn ? If so, there would be no want of help—but there should be at least three permanent hands. The models produced in this way, would be much better made than the original ones, and, by making a number of the same kind, the expense would be much less. By those models being scattered into the different States, they could not all be lost by any casualty by fire or otherwise, and these little nests of models might serve as a nucleus in each State, around which the products of the ingenuity and skill of its own inhabitants might be collected.

PHILO.

For the Young Mechanic.

GEOMETRY AND ARITHMETIC.

MESSRS. EDITORS—Although there is no royal road to Geometry, and whoever masters this subject must do it by a great deal of patient study, yet I believe for practical purposes, we may learn enough to enable us to get along very well, without straining our mental powers to any great extent. I intend, if agreeable, to give a few essays on this subject, which I hope will be useful to our Young Mechanics. And, as Geometry is seldom applied to practice without the aid of Arithmetic, I shall pursue both of these subjects in connection, and give some of their applications to the common purposes of life. It will not be necessary for my purpose to give the usual axioms, definitions, &c. at the commencement, as I hope to explain myself as I proceed.

AREA AND BOUNDARY.

PROPOSITION.—Figures of equal areas, if their shapes are different, the whole length of their boundary lines will be different also.

Example 1. Figure 1 is a square. The length of each side is equal to one inch, and its area is equal to a square inch.

Fig. 1.

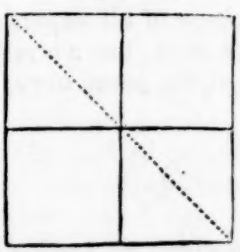

Fig. 2.

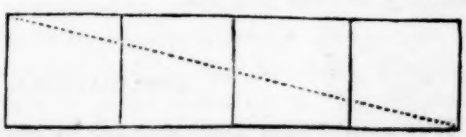

Figure 2 is an Oblong, or rectangled Parallelogram. The length is two inches, and breadth half an inch. Its area is the same as the square, equal to a square inch ; but the length of the boundaries of these two figures is different ; that of fig. 1 is four inches, and of fig. 2, five inches ; and the more the figure differs from a true square, the greater will be the difference between their areas and boundary lines.

Example 2. Triangles are subject to the same rule, which may be seen by inspecting the two figures above. The dotted diagonal lines, drawn across from opposite angles, divide each figure into two triangles, each containing half a square inch ; but the boundaries of the triangles, in fig. 2, are longer than those in fig. 1.

Example 3. Figure 3 is a Circle of one inch in diameter. Its area is rather more than three-fourths of a square inch.

Fig. 3.

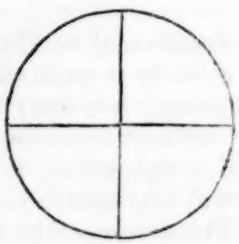

Fig. 4.

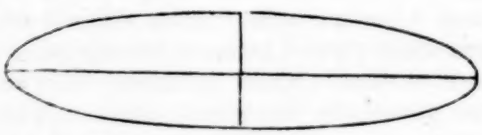

Figure 4 is an Ellipsis ; the longer diameter is two inches, and the shorter diameter half an inch. Its area is the same as that of the circle. Their areas are found by multiplying one diameter by the other, as in four-sided figures we multiply the length by the breadth. The products of one will be square inches, and of the other circular inches, which may be reduced to square inches, by multiplying them by the common factor 0.7854, which is the proportion of a circular inch in a square inch, namely, rather more than three-fourths. Although the areas of these two figures are equal, there is a considerable difference in their boundaries : that of fig. 3 is three inches and one-seventh, and of fig. 4, between four and five inches ; and the more the figure differs from a true circle, the greater will be the difference between their areas and boundary lines.

Example 4. The Circle is the most capacious of all superficial figures. One whose area is equal to a square inch, has a boundary of three inches and a half ; but a Square, of the same area, has a boundary of four inches.

APPLICATIONS.

1. If it would cost four dollars to inclose a piece of land, or to form any vessel whose shape is like fig. 1, it would cost five dollars to perform the same work if shaped like fig. 2.

2. If a vessel that is made round, should, by accident or otherwise, be flattened a little, or put out of a true circular form, it will not hold so much.* This would effect our measures, such as the bushel, gallon, &c. And hence the absurdity of measuring with a sack, which may be made to assume a variety of forms.

3. We find, where it can conveniently be done, advantage is taken of the great capacity of the circular form, by coopers, glass-blowers, founders, &c. The convenience, in rolling casks, and the

* The same may be said of the Square, which will be demonstrated in my next communication.

strength of them, and of glass ware, &c. must also be taken into consideration.

4. Although it is real economy to use those forms of vessels, which require the least quantity of materials in their construction, yet there are cases where it would be equally economical to adopt a contrary course. I allude to the processes of heating and cooling. A stove funnel, if made flat instead of being round, would give out more heat; for the simple reason, that the air which passes up the centre of a round pipe, is further from its sides, and cannot part with its heat so readily as it would if passing up a flat pipe. The same may be said of steam pipes, whether employed for heating rooms, or for boiling liquids, and other chemical processes. For cooling, flat pipes are better than round, for the same reason that none of the vapor, &c. is far from the sides. Brewers, distillers, gas-makers, and others, might profit by adopting these suggestions.

PHILO.

For the Young Mechanic.

MESSRS. EDITORS—In your last number, speaking of Mr. Hale's patent, you say, 'the improvements in propelling, proposed by Mr. Hale, consist '*in driving water forcibly out at the stern of the vessel under the water line.*' As it appears, Mr. Hale's patent was granted 13th Occtober, 1831. I wish you to state that the same principle was adopted by a person in this city, and for the same purpose, in the year 1825, as may be seen by a letter in the Patent Office, which describes his invention; and was sent there for the purpose of securing the patent right to the said individual, whenever he might wish to take out a patent. Various causes have induced a delay, but not a relinquishment of his purpose. A general outline of this plan was also published about two years since, embracing the same principle, in the Evening Gazette, of this city. As I have not seen all your remarks on Mr. Hale's patent, I am unable to understand the whole of his invention, and merely wish to state, without any ill-will toward him, that the principle alluded to, in his patent, is not an original one. I hope Mr. Hale will succeed in his useful undertaking, but, at the same time, I trust he would not knowingly encroach upon the rights of others.

FULTON.

The remarks on Mr. Hale's patent, alluded to by Fulton, are by the Editor of the Register of Arts; and the patent is an English one. We would observe, with regard to the letter in the Patent Office, that the Superintendent has said that filing a caveat in that office, afforded no security, and would not prevent a patent being granted for a similar thing to another person.—EDS.

For the Young Mechanic.

EVIDENCES OF THE ROTARY MOTION OF THE EARTH.

MESSRS. EDITORS—A few evenings since, I attended an interesting lecture on Astronomy, delivered before the Mechanics Charitable Association, by Professor Farrar, in which he treated of the evidence afforded for believing the Pythagorian, or Copernican System to be true. Among the evidences which he adduced, in the course of his reasoning, was one, which appeared to me to militate so strongly against the received opinions laid down in works on Natural Philosophy, in regard to the laws of motion, that I have taken the liberty to place it before your readers, together with a few remarks, not merely for the purpose of cavilling, or criticising, but for the pleasure of being satisfied in regard to the truth of the statement then made. The assertion was in substance as follows:—that one evidence of the earth's revolving on its axis, was deduced from the fact, that a body let fall from some distance above the earth's surface, as from the top of Park-street steeple, would not strike a point directly under it, but would strike the earth west of that point. This doctrine is diametrically opposed to that which I have generally understood, from all other writers on this subject. If this is a fact, Dr. Arnott is certainly wrong in accusing a mariner of story-telling, because he asserted, as a proof of the fast-sailing of his favorite ship, that a sailor, one day, falling from the mast-head, fell into the water, in consequence of the ship slipping from under him, before he reached the deck. And again, that he was a foolish man, who, reflecting that the earth turns round once in twenty-four hours, proposed rising in a balloon, and waiting aloft, until the country which he desired to reach, should be passing under him. Surely, both the mariner and the projector must be correct, if a ball, falling from the top of a steeple, would strike the earth west of a point immediately under it, because the earth had turned east, during its descent from the steeple to the earth. But, instead of this, would not the sailor fall to the deck, the projector wait in vain for the desired country, and the ball fall directly to the point underneath, by obeying the law of motal inertia? To produce an effect contrary to this law, must not the sailor be free from all connection with the vessel—the man, with his balloon, beyond the attraction or influence of the earth—and the ball dropt from a point, entirely free from the action of a moving body? Grund says, in regard to this, that 'all bodies in motion have the power of imparting that motion to other bodies.' Thus, in equestrian performances, we are surprised to see a man, in leaping over garters, hoops, &c. always alight safely on the back of the horse, even when at full speed. Here is the effect of this power—the man does not spring forward, as it appears to us, but merely frees himself from the horse, when

the progressive motion he had acquired, in connection with the horse, still continues to act, and he goes forward, with the same speed, until he has reached in safety his former place on the saddle. If this is true, the 'fact' asserted by the lecturer must be incorrect, because the ball, being connected with the earth, must have acquired the same motion, and, when dropt, would still obey the same impulses, and must necessarily strike the point perpendicularly under it. It appears to me to be a serious difficulty, to determine whether the ball does strike west of the point or line, for if a plumb and line were used, it would certainly be subject to the same laws as the falling body, and therefore could be no guide.

I will not attempt to enter the labyrinth of speculation in regard to this subject, as I feel satisfied, that, by so doing, I should not arrive at any determinate result; and, furthermore, from the well known courtesy of the gentleman referred to, I feel assured that he will not hesitate to correct any erroneous impressions which may have been received from his lectures. J. M. W.

ESSAYS ON KNOWLEDGE.

I have concluded to write a series of Essays for the Young Mechanic, under the above head, if they shall prove acceptable. This subject is chosen, because it will afford me ample opportunity to range over any field of knowledge which I may be able to explore. I shall commence with the following

INTRODUCTION.

The Author of the universe wants every intelligent being to be a free and deep thinker. This is plain from the fact, that his creatures can enjoy their existence in his boundless creation only in proportion to the extent of their knowledge, and that his benevolence would be very limited, did he not give them this freedom of thought, they being unable to obtain extensive information in any other way. If this be not true, why were we endowed with the noble capacity for reading and reflecting upon the glorious Volume of Nature; and why was it placed before us in all its magnificence, so well calculated to awaken a desire for an acquaintance with its sublime revelations?

Every mind, just so far as it does not possess a taste for the pursuit of knowledge, is in an unnatural state. This I infer from the preceding remarks; and I think that both the observations and the inference, upon examination, will prove to be sound. I would therefore advise every one who does not possess a taste for study, to reflect upon his situation as a member of the universe of Jehovah; to reflect upon the time he has wasted during his life in [illegible]less employments, which were calculated to blunt his natural sensibilities; and to resolve for the future to let his conduct be more worthy of the exalted place which he holds in this splendid creation.

I look upon the people of this world as a class of scholars in one of the great school-rooms of Deity. The only reason why all are not good pupils, is the wrong practices of the world—as is hinted in the advice just given ; and these practices have debased the mind so as to lead it to all the low, grovelling pursuits which are common in the world. But the prospect that the great body of the people will, at some future period, be roused to the exercise of its high intellectual powers, is daily brightening. The means in operation for waking up and perpetuating a taste for intellectual improvement, were never so great as at the present day. 'The fountains of the great deep have been broken up ; and a deluge of information—theological, scientific, and civil—is carrying all before it, filling up the vallies, and scaling the mountain tops. A spirit of enquiry has gone forth, and sits brooding upon the mind of man. As to the effect, much will depend upon right regulation and direction.'

No sound objection can be brought against the universal spread of knowledge. We were made to be reasonable beings : and 'how can we reason but from what we know ?' The world has reasoned superficially, comparatively speaking, long enough. Give the great mass of the people facts—the more the better ; and let them reason from them ; and then we may look for an extensively enlightened public sentiment on all important subjects. Until this be done, the ten thousand divisions of the world must continue to exist : for doctors must disagree while the mass of the people remain in ignorance—because the intellect of the whole world is needed to decide many of the important questions which are, and ever have been agitated in the world.

It is the duty of every one, then, who perceives the great advantages of universal education, to do all in his power to dissipate the clouds of ignorance which still hang over our globe, in order to hasten the period when the sun of knowledge shall gleam upon the world in all its meridian splendor. L.

From Prof. Babbage's Work on Economy of Machinery, &c.

CONVENIENT METHOD OF GUAGING.

The time and labor consumed in guaging casks partly filled, has led to an improvement which, by the simplest means, obviates a considerable inconvenience, and enables any person to read off, on a scale, the number of gallons contained in any vessel as readily as he does the degrees of heat indicated by his thermometer. A small stop-cock is inserted near the bottom of the cask, which it connects with a glass tube of narrow bore fixed to a scale on the side of the cask, and rising a little above its top. The plug of the cock must be turned into three positions : in the first it cuts off all communication with the cask ; in the second, it opens a communica-

tion between the cask and the glass tube : and in the third, it cuts off the connexion between the cask and the tube, and opens a communication between the tube and any vessel held beneath the cork to receive its contents. The scale of the tube is graduated by opening the communication between the cask and the tube, and pouring into the cask a gallon of water. A line is then drawn on the scale opposite the place in the tube to which the water rises. The operation is repeated, and at each successive gallon a new line is drawn. Thus the scale being formed by actual measurement, both the proprietor and the excise officer see, on inspection, the contents of each cask, and the tedious process of guaging is altogether dispensed with. Other advantages accrue from this simple contrivance, in the great economy of time which it introduces, in making mixtures of different spirits, in taking stock, and in receiving spirits from the distiller.

INVENTION AND DISCOVERY.

The object of the former is to produce something which had no existence before ; that of the latter, to bring to light that which did exist, but which was concealed from common observation. Thus we say, Otto Guericke invented the air-pump ; Sanetorius invented the thermometer ; Newton and Gregory invented the reflective telescope ; Galileo discovered the solar spots ; and Harvey discovered the circulation of the blood. It appears, therefore, that improvements in the arts are properly called inventions, and the facts brought to light, by means of obsorvation, are properly called discoveries.

TIME.

It may be thought, that a considerable portion of the community *want time* to attend to the cultivation of their minds. But it is only necessary to make the experiment, to find *two things;* one, how much useful knowledge can be acquired in a very little time; and the other, how much time can be spared, by good management out of the busiest day. Generally speaking, our duties leave us time enough, if our passions would but spare us ; our labors are much less urgent in their calls upon us, than our indolence and our pleasures. There are very few pursuits in life, whose duties are so incessant, that they do not leave a little time every day to a man, whose temperate and regular habits allow him the comfort of a clear head and a cheerful temper, in the intervals of occupation; and then there is one day in seven which is redeemed to us, by our blessed religion, from the calls of life, and affords us all time enough for the improvement of our rational and immortal natures. —*Everett's Address.*

QUESTION.

Three men were employed to draw a load of plaster from Boston to Windsor, for $26,45, each man having one horse. A and B's horses are supposed to do 3-4 of the work, A and C's 9-10, and B and C's 13-20. They are to be paid proportionally. What is each man's share of the money? B.

ANSWER.

If the proposer means to be understood that A and B are to receive 3-4 of the $26,45, and A and C 9-10, and B and C 13-20, it is no wonder that the two schoolmasters were unable to solve so absurd a problem. But if he means that the sum of A & B's shares, shall be to the sum of A and C's as 3-4 to 9-10, and to B and C's as 3-4 to 13-20, (which I infer he does mean by the expression 'they are to be paid proportionally,') then I see not the least difficulty in the solution.

Let $x : y$: : A's share : B's share, and $y : z$: : B's share to C's.

Likewise let $x+y=3\text{-}4$

Then $x+z=9\text{-}10.$

And $y+z=13\text{-}20.$

Then $$\frac{(2x+y+z)-(y+z)}{2}=x=1\text{-}2$$

And $$\frac{(2y+x+z)-(x+z)}{2}=y=1\text{-}4$$

And $$\frac{(2z+x+y)-(x+y)}{2}=z=2\text{-}5$$

Then $x+y+z=23\text{-}20$

Then
23-20 : 26,45 : : 1-2 : 11,50=A's share.
23-20 : 26,45 : : 1-4 : 5,75=B's share.
23-20 : 26,45 : : 2-5 : 9,20=C's share.

$26,45=Total.

If 'A Subscriber' will inform us by what process he gets 'one mill and a fraction too much,' he will perhaps throw additional light on the 'singularity' of this *very abstruse* question!

NO SCHOOLMASTER.

QUESTION.

The fore wheel of a carriage makes six revolutions more than the hind wheel, in going 120 yards; but if the periphery of each wheel be increased one yard, it will make only four revolutions more than the hind wheel in the same space. Required the circumference of each wheel.